GOOSE LAKE AGRICULTURAL WATER QUALITY PROGRAM

QUALITY ASSURANCE PROJECT PLAN

SWRCB Agreement No. 05-070-555-0

Plan Prepared by:

**The Goose Lake Resource Conservation District
On behalf of the Goose Lake Coalition**

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APPROVALS:

Grant Organization

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Project Manager	Julie Laird		
QA Officer	Don Lancaster		

Regional Board

Title:	Name:	Signature:	Date:
Grant/Contract Manager	Susan Fregien		
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3. Distribution List

Title:	Name (Affiliation):	Tel. No.:	QAPP No*:
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4. Project/Task Organization

4.1 Involved parties and roles.

The Goose Lake Resource Conservation District (GLRCD) is a non-regulatory, grassroots organization that has been established to provide local leadership to accomplish watershed-wide planning and stewardship of the land. As the lead agency on this project, the GLRCD will coordinate water quality monitoring efforts, sample collection, and field analysis of samples. The GLRCD will also initiate and maintain a contract with Basic Laboratory Inc. of Redding, California.

Herb Jasper is the GLRCD's project director. As a member of the GLRCD Board of Directors, Herb will serve as the primary representative of the conservation district and leader for the project. Herb will oversee the overall progress of the project and will serve as one of the primary contacts for communication between the GLRCD and the CVRWQCB.

Julie Laird is the GLRCD's project manager. She will work under Herb's direction to maintain contact with the contract laboratory and the CVRWQCB, ensure that the requirements of the grant agreement between the CVRWQCB and the GLRCD are fulfilled by preparing and submitting grant deliverables, and work with Dr. Don Lancaster as needed to carry out the monitoring and sampling activities described in this QAPP.

Basic Laboratory Inc. will be the contract laboratory for analysis of physical water quality parameters and drinking water quality. The laboratory will analyze submitted samples in accordance with the method and quality assurance requirements contained in this QAPP. Staff of the laboratory will also act as technical resources for the GLRCD project leadership.

Dr. Kenneth Tate, UC Davis Extension Rangeland Watershed Specialist, will serve as a technical advisor to this project. After conducting several intensive monitoring projects in the Goose Lake Basin, Dr. Tate is very familiar with the area's conditions, baseline water quality, and management practices. Though Dr. Tate will not be responsible for the delivery of any product as part of this project, his contributions in serving in an advisory role will be incredibly valuable to the success of these efforts.

Table 4.1 Personnel responsibilities.

Name	Organizational Affiliation	Title	Contact Information (Telephone number, fax number, email address.)
Herb Jasper	Goose Lake RCD	Project Director	(530) 946-4196 Phone (530) 946-4107 Fax bry.jasper@oregonstate.edu
Julie Laird	Goose Lake RCD	Project Manager	(541) 947-3868 Phone (541) 947-3868 Fax julielaird@wildblue.net
Katie Hawley	Basic Laboratory Inc.	Contract Laboratory Staff	(530) 243-7234 Phone (530) 243-7494 Fax khawley@basiclab.com

4.2 Quality Assurance Officer role

Dr. Don Lancaster is GLRCD's Quality Assurance officer. Dr. Lancaster's role will be to establish the quality assurance and quality control procedures included in this QAPP as part of the sampling and field analysis procedures. In addition, he will work with the quality assurance staff of Basic Laboratory Inc. to communicate all quality assurance and quality control issues contained in this QAPP to that laboratory.

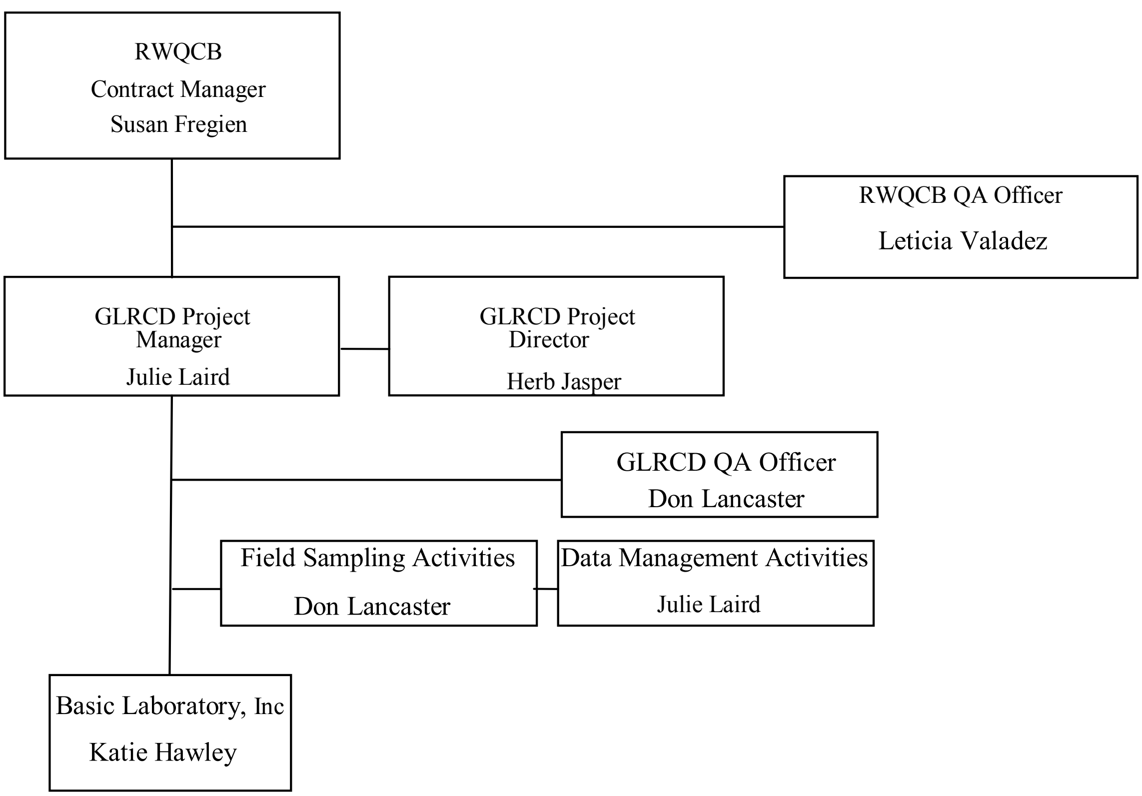
Dr. Lancaster will also review and assess all procedures during the life of the program to ensure that QAPP requirements are met. He will report any and all findings to the project director and project manager, including the need for any corrective action. Dr. Lancaster, working together with the project leadership team, may also stop all actions, including those conducted by Basic Laboratory Inc., if he deems that there are significant deviations occurring from required QAPP practices or if there is evidence of a systematic failure in upholding QAPP standards.

4.3 Persons responsible for QAPP update and maintenance

Changes and updates for this QAPP can be made after a review of the evidence for change by GLRCD's project manager and quality assurance officer, with the concurrence of both the Regional Water Quality Control Board's contract manager and quality assurance officer. GLRCD's project manager and the quality assurance officer will be responsible for and will work together to make QAPP changes, submit drafts for review, prepare a final copy, submit the final draft for signature, and send the approved revised versions to all those listed in the above Distribution List.

4.4 Organizational chart and responsibilities

Figure 4.4. Project organizational chart.



5. Problem Definition/Background

5.1 Problem statement

Though significant monitoring efforts have been conducted by the CVRWQCB, UCCE, and GLRCD in the Goose Lake Basin since the early 1990's, ongoing collection of information is warranted to document the effects of irrigated agriculture management practices and to ensure that the contribution of any discharges from irrigated agriculture do not violate water quality standards or interfere with the beneficial uses of waters of the state. This monitoring will be conducted in order to continue to fulfill the requirements of the "Conditional Waiver of Waste Discharge Requirements for Discharge from Irrigated Lands" (Conditional Waiver) and help stakeholders detect and proactively address any impacts that may arise. The monitoring program for which this QAPP has been prepared will assess ambient stream water quality and quantity below irrigated agriculture production activities within the California portion of the Goose Lake Basin Watershed. This monitoring strategy is designed to document any effects on stream water quality and impacts to beneficial uses attributable to irrigated agriculture activities. The resulting data will allow for the evaluation of long-term water quality trends, identification of any areas in need of improved management practices to protect water quality, and the future evaluation of water quality improvement resulting from the implementation of strategic management practices in places where impairments are identified.

5.2 Decisions or outcomes

Through the development and implementation of the monitoring plan, as described above, this project will provide ongoing information about the water quality within the Goose Lake Basin. This information will be integrated with results from previous research conducted through the GLRCD's joint monitoring efforts with UCCE as well as the Goose Lake Coalition's previous Irrigated Lands Regulatory Program (ILRP) monitoring to continue to assess the effects of waste discharge from irrigated lands on water quality and determine if the beneficial uses of waters of the state are being impaired.

In order to do this, we have selected a list of physical, chemical, and microbial parameters for this monitoring and reporting effort that past research has conclusively shown to be both 1) indicative of the types of water quality problems that can be associated with the grazing systems and hay production practices of our area, and 2) responsive to irrigation and grazing management practices common in the Goose Lake Basin. Any changes in pasture and/or irrigation management will be indicated by the set of water quality metrics we have proposed, as described in subsequent sections of this plan.

The monitoring approach focuses on three major components: 1) Core Monitoring, 2) Assessment Monitoring, and 3) Special Project Monitoring. Based on the requirements of the CVRWQCB's MRP Order, the different types of monitoring will occur on a 3-year cycle, with Core Monitoring in 2009 and 2010, followed by Assessment Monitoring in 2011. This cycle will then repeat, beginning with Core Monitoring in 2012. Special Project Monitoring will be performed when exceedances are identified and there is a need to determine the source or cause of the problem.

If any of the monitoring results in the detection of water quality problems related to irrigated agriculture, the information collected through this project will be utilized to assess the sources and impacts of the discharged waste as well as to determine Best Management Practices (BMPs) that can mitigate future water quality and aquatic habitat impacts. Effective BMPs will be implemented as field demonstrations for basin stakeholders, and other possible BMPs will be presented to growers through workshops and printed materials so that stakeholders are informed of local water quality issues and what they can do to minimize the impacts from their own operations.

Through this project, the Goose Lake Coalition Group will continue to become a fully functional and self-sustaining entity. Under the current monitoring strategy, all the parameters we have included can be measured in the field with quality-calibrated meters, with the exceptions of *E. coli,* Total N, Total P, ammonia, and macroinvertebrate sampling. This will help to both control laboratory costs and provide real time data to guide on-the-ground management practices throughout the irrigation season. Further, this project will continue to improve current information sources of existing agricultural management practices and ongoing water quality protection efforts throughout the basin through the development of a comprehensive database that is available to Coalition members.

Ultimately, this project will result in enhanced understanding of irrigated agriculture in the Goose Lake Basin by the agricultural community, the CVRWQCB, and other stakeholders that will continue and expand the implementation of sound management practices and the development of appropriate regulations to sustain water quality in the basin.

5.3 Water quality or regulatory criteria

Currently, the State Water Resources Control Board (SWRCB) has not identified any of the waterbodies within the California portion of the Goose Lake Basin as impaired under Section 303(d) of the federal Clean Water Act (CWA). The project will utilize, however, the following limits and objectives from the CVRWQCB Basin Plan for the Sacramento River Basin to determine the magnitude of any impact from irrigated agriculture discharges:

- Waterbody Specific Limits: For Goose Lake, specifically, pH must be in the range of 7.5 - 9.5 units at all times, and total dissolved solids (TDS) cannot exceed 1,300,000 tons.
- Narrative Objectives: Water quality results will be evaluated to determine if compliance with Basin Plan narrative objectives are met.

Further, water quality conditions will be evaluated to determine if they are protective of the following beneficial uses identified for Goose Lake: irrigation, stock watering, contact recreation, noncontact recreation (other than canoeing and rafting), warm freshwater habitat, cold freshwater habitat, and wildlife habitat.

Lastly, based on the beneficial uses described above, the water quality criteria and objectives listed in Table 5.3 will be utilized to compare with monitoring results to determine whether exceedances have occurred.

Table 5.3 Water quality criteria and objectives that will be utilized to determine whether exceedances have occurred.

Monitoring Parameter	Water Quality Criteria and Objectives
Instantaneous Streamflow	Not applicable
pH	pH shall be > 6.5 and < 8.5* Changes in normal ambient pH levels shall not exceed 0.5* For Goose Lake itself, pH shall be > 7.5 and < 9.5*
Electrical Conductivity	Though no specific EC criteria exists for the Goose Lake Basin, limits set for similar upper watershed areas suggest that EC shall not exceed 150 µmhos/com (at 25°C)*
Dissolved Oxygen	DO shall be ≥ 7.0 mg/L*
Water Temperature	The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature.*
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: --Where natural turbidity is between 0 and 5, NTU increases shall not exceed 1 NTU. --Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20%*
E. coli	235 MPN/100mL*
Ammonia	The effect of ammonia on freshwater aquatic life is pH and temperature dependent. For example, given that salmonids (i.e. redband trout) are present in the Basin, the maximum ammonia concentration at pH 7.3 should not exceed 17.5 mg/L. At pH 7.7, maximum ammonia concentration should not exceed 9.64 mg/L. At pH 8.2, maximum ammonia concentration should not exceed 3.83 mg/L. The Coalition will utilize the CVRWQCB's "Compilation of Water Quality Goals" table to determine whether exceedances have occurred based on the specific pH levels measured during each monitoring event. **
Total N	Total N should be <0.12 mg/L***
Total P	Total P should be <10.00 µg/L***

* Criteria from the Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River & San Joaquin River Basins by the Central Valley Regional Water Quality Control Board.

** CVRWQCB's "Compilation of Water Quality Goals", available at: www.waterboards.ca.gov/centralvalley/water_issues/water_quality_standards_limits/water_quality_goals/index.shtml. Ammonia criteria is on page 17 and is based on USEPA National Recommended Water Quality Criteria to Protect Freshwater Aquatic Life.

***Recommended EPA criteria for each of the aggregate nutrient ecoregions. The Goose Lake Basin is part of Ecoregion #2. Available at www.epa.gov/ost/criteria/nutrients/ecoregions.

6. PROJECT/TASK DESCRIPTION

6.1 Work statement and produced products

The monitoring portion of the project that this QAPP has been developed for will be implemented using three major types of monitoring as described below:

Core Monitoring: The Coalition's Core Monitoring strategy has been designed to describe water quality trends within the Goose Lake Basin. Though past monitoring efforts have revealed no major water quality issues, the monitoring sites, sampling frequency and parameters to be analyzed will help us determine if water quality conditions in waters of the state within our Coalition boundaries are getting better or worse through implementation of management practices identified through the ILRP as well as other watershed improvement efforts by the GLRCD and Goose Lake Fishes Working Group and Watershed Council.

Core Monitoring, as well as Special Project Monitoring if it is still needed, will be conducted each year, beginning in 2009. With the exception of *E. coli* and Total Ammonia samples that will be analyzed by Basic Laboratory, the Coalition's monitoring effort will focus on field-based constituents measured with quality calibrated meters. These parameters include instantaneous streamflow, pH, electrical conductivity, dissolved oxygen, water temperature, and turbidity.

Assessment Monitoring: The Coalition's Assessment Monitoring strategy is designed to continue to describe the water quality conditions within the Basin as well as contribute to our understanding of long-term water quality trends. The Assessment Monitoring will also help determine the magnitude and extent of any water quality problems that may develop.

Assessment Monitoring will be conducted every third year, beginning in 2011, and will include all Core Monitoring parameters. Additional parameters will be sampled to help examine trends, assess the effectiveness of management practice implementation, and guide future monitoring. These will include analyses of Total Nitrogen, Total Phosphous, and macroinvertebrate community composition. Additionally, the Coalition will monitor any changes in agriculture practices (based on information submitted by Coalition members) and pesticide use (using pesticide use reports from the Agricultural Commissioner) within the Basin annually and report any changes in the Annual Monitoring Report (AMR). If there is a change in any agriculture practice, or if there is reported pesticide use, the Regional Board will be notified so that the need for additional monitoring can be evaluated.

Special Project Monitoring: The Coalition will utilize this type of monitoring when water quality exceedances are detected through Core and/or Assessment Monitoring, and there is a need to determine the possible contributing source(s) from irrigated agriculture to the problem. Special Project Monitoring plans will be developed to help us estimate the relative importance of agriculture's contribution to the problem and determine management practices to alleviate the issue.

As of July 2008, the Coalition currently has one Special Project Monitoring plan, known as the Lassen Creek Management Plan (LCMP) for *Ceriodaphnia dubia* toxicity. The plan describes a targeted, site-specific study that will hopefully help us identify the source of the toxicity that was detected during the 2007 irrigation season while also determining its magnitude and extent. Though the Coalition is hopeful that the *C. dubia* toxicity issue will be resolved through the 2008 sampling effort, we will continue to execute the LCMP as long as necessary. Further, if other water quality problems arise in the future, similar actions will be taken to address them.

During each type of monitoring described above, photographs will be taken at each sampling site for each sampling event to document water, stream channel, and weather conditions at the time of sample collection.

Throughout this project, Monthly Progress Reports will be submitted, describing milestones achieved, monitoring results (if applicable), and any problems encountered in the performance of the work to fulfill the requirements of the grant contract between the CVRWQCB and the GLRCD. Monitoring results will be submitted to the CVRWQCB in Quarterly Monitoring Data Reports. The first report will cover from 1 January through 31 March and will be submitted by 1 June. The second report will cover 1 April through 30 June and will be submitted by 1 September. The third report will cover from 1 July through 30 September and will be submitted by 1 December. If no monitoring occurs during a given period, the associated quarterly data report will state that no monitoring occurred (as consistent with the Coalition's MRPP). The data reports will include electronic data submittal in SWAMP comparable format as well as copies of all field, laboratory, and quality control reports.

Further, the Coalition will submit an annual report by 1 March each year that covers all monitoring from the previous calendar year. The Coalition will include all elements described in the MRP Order, including electronic data submitted in SWAMP comparable format. In addition to the tabulated results of all analyses as submitted in the data reports, the annual report will also include a complete discussion of the monitoring results, updates on pesticide use or changes in agricultural practices, conclusions and recommendations that can be drawn from the current year's efforts, and any actions taken to address water quality exceedances. The Coalition will also include updates on outreach efforts to Basin growers as well as the progress made in the identification and implementation of management practices within the watershed. All information will be presented in a way that compliance with the Conditional Waiver is readily discernible. Lastly, Draft and Final Project Reports will be submitted to the CVRWQCB summarizing the results and accomplishments throughout the project, as required by the grant agreement.

6.2 Monitoring frequency and number of samples to be collected

The monitoring frequency will be monthly during the irrigation season, plus one event during the snowmelt season before irrigation begins, and another event in the fall after the irrigation season when streamflow increases after the summer base flow period. The Coalition will make every attempt to schedule the fall sampling event following a rain event. Thus, assuming a 4-month irrigation season, a total of 6 sampling events per year (4 irrigation season samples + 1 snowmelt event + 1 fall event = 6 events) are expected. If the irrigation season is cut short due to low snowpack in a given year, the total amount of samples will vary accordingly. Please note that in addition to the sample totals given above, we will also collect one duplicate sample per sampling event. With these duplicates included, we will actually collect approximately 12 samples of all parameters for the type of monitoring being conducted each year.

6.3 Project schedule

Table 6.3 contains the project schedule for monitoring dates during the first 3-year cycle of Core and Assessment Monitoring. Beginning in 2012, this same cycle will repeat.

Table 6.3 Sampling schedule for the first 3-year monitoring cycle.

Year	Monitoring Type(s)	Season	Sampling Dates*	Targeted Conditions
2009	Core, Special Project if needed	Snowmelt (pre-irrigation)	4/1/09 through 4/30/09	One sample event during spring snowmelt
		Irrigation season	5/1/09 through 8/31/09	Monthly sampling during irrigation
		Fall (post-irrigation)	9/15/09 through 11/1/09	One sample event after a rain event
2010	Core, Special Project if needed	Snowmelt (pre-irrigation)	4/1/10 through 4/30/10	One sample event during spring snowmelt
		Irrigation season	5/1/10 through 8/31/10	Monthly sampling during irrigation
		Fall (post-irrigation)	9/15/10 through 11/1/10	One sample event after a rain event
2011	Assessment, Special Project if needed	Snowmelt (pre-irrigation)	4/1/11 through 4/30/11	One sample event during spring snowmelt
		Irrigation season	5/1/11 through 8/31/11	Monthly sampling during irrigation
		Fall (post-irrigation)	9/15/11 through 11/1/11	One sample event after a rain event

*Specific sampling dates will be determined based on the length of each year's irrigation season.

Results of these monitoring efforts will be submitted to the CVRWQCB in Quarterly Monitoring Data Reports, the first of which will be sent in by 1 June 2009, covering the period of 1 January 2009 through 31 March 2009. The second report will cover 1 April 2009 through 30 June 2009 and will be submitted by 1 September 2009. The third report will cover from 1 July 2009 through 30 September 2009 and will be submitted by 1 December 2009. If no monitoring occurs during a given period, the associated quarterly data report will state that no monitoring occurred (as consistent with the Coalition's MRPP). The data reports will include electronic data submittal in SWAMP comparable format as well as copies of all field, laboratory, and quality control reports. Further, the Coalition will submit an annual report by 1 March 2010 that covers all monitoring from 2009. This schedule of reports will continue through all subsequent years of this monitoring program.

6.4 Geographical setting

The Goose Lake Basin watershed stretches across the border between northeastern California and south-Central Oregon (as shown in Figure 6.4.1). The high desert watershed encompasses 1,140 square miles of land that drains from both the west and the east into Goose Lake, a closed-basin lake system that no longer has a surface outlet to the nearby Pit River. Elevations within the watershed range from 8,000 feet in the Warner Mountains down to 4,693 feet at average lake level. The annual precipitation throughout the basin is between 15 and 20 inches, much of it occurring as snow. Vegetation ranges from mixed conifer forests in the Warner Mountains to sagebrush-dominated shrublands, grasslands, and marshes descending from the mountains towards the lake. Approximately 50 percent of the watershed is privately owned, with these lands being used predominately for livestock grazing and both irrigated and dryland hay production. The remainder of the land is publicly owned and is predominately managed by the U.S. Forest Service and the Bureau of Land Management (BLM). Overall, less than four percent of the land area of the basin is cultivated, and fertilizer and pesticide use is minimal.

Figure 6.4.1 The Goose Lake Basin and surrounding area

For the purposes of our project, the water bodies to be covered by the Goose Lake Coalition include the creeks located within the California side of Goose Lake Basin. Lassen and Willow Creek are the major water bodies on the California side of the basin that flow into Goose Lake. Six additional creeks (Cottonwood, Barnes, Davis, Roberts, Linnville, and Franklin) never reach the lake but instead end in terminal wetlands. These creeks and their tributaries are important for aquatic habitat benefits and aesthetic quality, in addition to contributing to local supplies for agricultural uses.

In this monitoring effort, one primary monitoring site will be considered representative of the Coalition area as a whole. This site, known as Lower Lassen Creek, or LC 1, is located below all irrigated agriculture activities in the Lassen Creek drainage. The site is below Highway 395 but immediately above where the local railroad crosses the creek. Directly upstream of the sampling site are irrigated meadows used for both hay production and livestock grazing. The sampling site is near a traditional crossing site where ranch vehicles and hay equipment move across the stream channel. All samples have been and will continue to be collected above the crossing to avoid any influence of the crossing in our results. Figures 6.4.2 and 6.4.3 show the LC 1 monitoring site, including the entrance to the sampling location and overview of the area, as well as the upstream and downstream views from the sample site. The yellow arrow in Figure 6.4.3 indicates the approximate location where samples will be collected.

Figure 6.4.2 Entrance to the Lower Lassen Creek (LC 1) sampling site and general site overview.

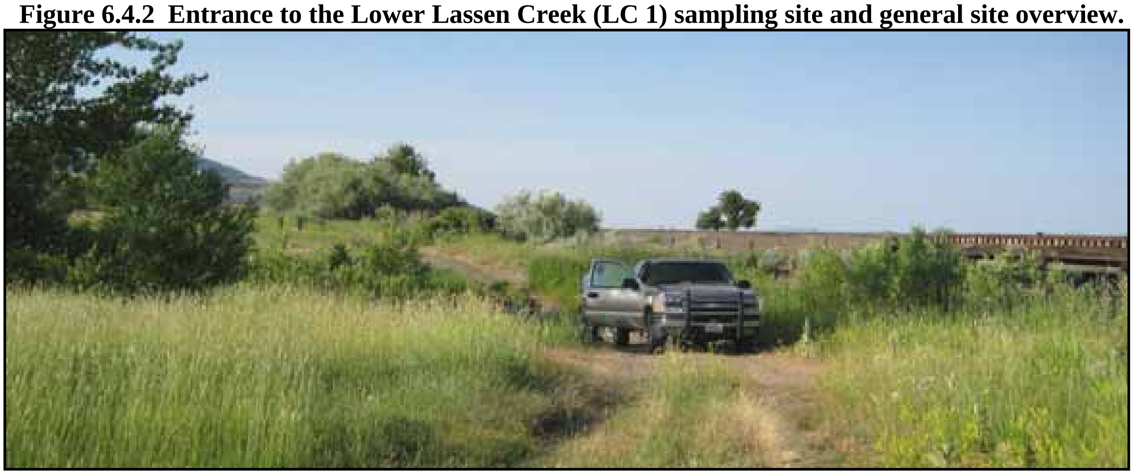


Figure 6.4.3 Lower Lassen Creek sampling site (LC 1), facing upstream (left) and downstream (right).

6.5 Constraints

The timing and duration of the irrigation season in the Goose Lake Basin is highly dependent upon the amount of annual snow pack and when snow melt occurs. The sampling dates listed in Table 6.3 may have to be adjusted based on these factors so that adequate and representative samples can be obtained.

7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

In order to ensure that the data collected is adequate for achieving the objectives of this project, standard accepted methods will be used to collect and analyze samples. This section identifies how accurate, precise, recoverable and complete our measurements will be. The practical quantitation limits (PQLs) and analytical methods are also listed for each water quality parameter.

These data quality objectives were derived from the CVRWQCB's Quality Assurance Project Plan Guidelines for Order No. R5-2008-0005, Coalition Group Monitoring and Reporting Program. Specifically, the data quality objectives are contained in Appendix B of the QAPP guidelines. Sections 12-14 of this plan contain the details describing the actions to be taken if data quality objectives are not met. Any previously collected information to be used in this current project must meet the data quality objectives described in this section.

Project action limits for all parameters being measured will be based on the water quality and regulatory criteria included in Section 5.3 of this QAPP. Based on CVRWQCB's Basin Plan, that section describes the specific water quality limits that have been set for Goose Lake, as well as the other water quality objectives that must be met in order to not impair the beneficial uses of these waters.

7.1 Data Quality Objectives

The measurements and analyses types specific to this project are listed in Table 7.1. Applicable data quality objectives are specified for each measurement or analysis type to be performed. In addition to the parameters listed, photographs will also be taken at each sampling site for each sampling event to document water, stream channel, and weather conditions at the time of sample collection.

Table 7.1 Quality objectives and criteria for measurement data

Group	Parameter	Accuracy	Precision	Recovery	Completeness
Field Testing	Instantaneous Streamflow	± 0.2 cfs	± 0.2	NA	90%
	pH	± 0.5 units	± 0.5 or 5%	NA	90%
	Electrical Conductivity	± 5%	± 5%	NA	90%
	Dissolved Oxygen	± 0.5 mg/L	±0.5 or 10%	NA	90%
	Water Temperature	± 0.5 °C	± 0.5 or 5%	NA	90%
	Turbidity	± 10% or 0.1%, whichever is greater	± 10% or 0.1%, whichever is greater	NA	90%
Laboratory Analyses	*E. coli*	Laboratory positive and negative cultures—proper positive or negative response. Bacterial PT sample—within the stated acceptance criteria.	Rlog within 3.27*mean Rlog (reference is section 9020B of 18th, 19th, or 20th editions of Standard Methods.	NA	90%
	Ammonia	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by provider of material. If not available, then within 80% to 120% of true value.	Laboratory duplicate, Blind Field duplicate, and MS/MSD ± 25% RPD if Result > 10X the MDL. Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	90%
	Total N	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by provider of material. If not available, then within 80% to 120% of true value.	Laboratory duplicate, Blind Field duplicate, and MS/MSD ± 25% RPD if Result > 10X the MDL. Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	90%
	Total P	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by provider of material. If not available, then within 80% to 120% of true value.	Laboratory duplicate, Blind Field duplicate, and MS/MSD ± 25% RPD if Result > 10X the MDL. Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	90%

Accuracy

Accuracy describes how close the measurement is to its true value. Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value. The accuracy of chemical measurements will be checked by performing tests on standards by the contract laboratories. A standard is a known concentration of a certain solution. The concentration of the standards should be within the mid-range of the equipment. All field and laboratory instrumentation will be calibrated to manufacturer's specifications by the project field staff and by the appropriate contract laboratory staff. Accuracy for bacteria will be determined by analyzing a positive control sample twice annually. A positive control is similar to a standard, except that a specific discreet value is not assigned to the bacterial concentrations in the sample. This is due to the fact that bacteria are alive and capable of mortality and reproduction. Instead of a specific value, an approximate target value of the bacterial concentration is assigned to the sample by the laboratory preparing the positive control sample. Accuracy of measurements and analyses will be included with each Quarterly Data Report as well as in the Coalition's Annual Report.

Precision

Precision describes how well repeated measurements agree, assuming that the constituent of concern is uniformly distributed between the duplicate samples. The evaluation of precision for field and laboratory determined constituents will be determined by the project field staff and contract laboratory staff from repeated measurements taken by either different staff on the same sample or the same staff analyzing split samples. Precision for bacterial parameters will be determined by having the same analyst complete the procedure for laboratory duplicates of the same sample. At a minimum this should be done once per day, or run duplicates on a minimum of 5% of the samples if there are over 20 samples run per day. The results of the duplicates should be within the 95% confidence limit of its pair. Precision of measurements and analyses will be included with each Quarterly Data Report as well as in the Coalition's Annual Report.

Recovery

Recovery is the accuracy of an analytical test measured against a known analyte addition to a sample. It will provide a basis for determining the prevalence of matrix effects in the samples analyzed during the project. Recovery measurements will be determined by laboratory spiking of a replicate sample with a known concentration of the analyte. The target level of addition is at least twice the original sample concentration. Recovery will be reported both in the Quarterly Data Reports and Annual Reports.

Completeness

Completeness is the fraction of planned data that must be collected (and determined to be valid) in order to fulfill the statistical criteria of the project. Volunteer data will not be used for legal or compliance uses. There are no statistical criteria that require a certain percentage of data. However, we will strive to meet the goal of 90% completeness for all measurements and analyses. This accounts for adverse weather conditions, safety concerns, equipment problems, sample breakage during transport or handling, laboratory error, or insufficient sample volume.

Project completeness is divided into two areas: Field and Transport Completeness and Laboratory Completeness. Field and Transport Completeness refers to the complete event process of successful planned site visit, conditions documentation, in-field measurements, sample collection technique and volume, in-field quality assurance and control sample preparation, chain-of-custody documentation, preservation, and successful transport of samples to the receiving laboratory. If a site is inaccessible or dry, the Coalition will document these conditions through field sheets, photos, and other means in order to meet the completeness goal for that site and event. Laboratory Completeness refers to the complete event process of sample reception, chain-of-custody documentation, storage, and in-house preservation, extraction, analysis, and laboratory quality assurance and control samples and measures.

We will determine completeness by comparing the number of measurements analyses we planned to collect to the number of measurements we actually collected that were also deemed valid. An invalid measurement would be one that does not meet the measurement quality objectives. Completeness goals will be applied to all aspects within both the Field and Transport Completeness and Laboratory Completeness. Completeness results will be calculated and reported with each Quarterly Data Report as well as summarized in the Annual Reports. This will allow us to identify and correct any problems.

Representativeness

In addition to the quality objectives described above, the Coalition will also evaluate data for representativeness. Representativeness describes how relevant the data are to the actual environmental condition. An important part of Dr. Ken Tate's advisory role on this project has been, and will continue to be to actively participate in sample design development, training, and assessment of representativeness of the resulting data. Bias (lack of representativeness) can occur if:

- Samples are taken in a stream reach that does not describe the area of interest (e.g., below agricultural source sample is collected below a city and the agricultural source),
- Samples are taken in an unusual habitat type (e.g. a stagnant backwater instead of in the flowing portion of the creek),
- Samples are not analyzed or processed appropriately, causing conditions in the sample to change (e.g. bacteria concentrations not determined within 24 hours of collection).

Representativeness and resulting bias will be controlled via appropriate sample sites selection and sample collection timing (as described in this document, the project's Monitoring and Reporting Program Plan (MRPP), and the SWAMP Quality Assurance Management Plan, Appendix D, "Site Selection Guidelines" (http://www.swrcb.ca.gov/swamp/docs/appxd_guidelines.doc). Sampling locations will be selected that adequately represent all of the discharges from the project area and all of the affected water bodies. Further, we will adhere to all sampling procedures and sample holding time requirements as well.

Comparability

Lastly, we will ensure that the data collected through this ILRP monitoring effort is comparable in content and quality to statewide consistency goals outlined by the SWAMP program. To ensure this comparability, we are submitted an acceptable MRP Plan for approval and this project QAPP so that our data will be consistent with other State monitoring programs and projects.

7.2 Practical Quantitation Limits (PQLs) and Analytical Methods for Monitoring Parameters

The Practical Quantitation Limit (PQL) (also called reporting limit) is the level above which numerical results may be obtained with a specified degree of confidence, or the minimum concentration of an analyte, or category of analytes, in a specific matrix that can be identified and quantified within specified limits of precision and accuracy during routine analytical operating conditions. Further, the Method Detection Limit (MDL) is the lowest possible concentration an instrument or piece of equipment can detect. This is important to record because we can never determine that a pollutant was not present, only that we could not detect it. Sensitivity is the ability of the instrument to detect one concentration from the next. The analytical methods, PQLs, MDLs and Sensitivities are noted in Table 7.2 for each water quality monitoring parameter.

Table 7.2 Analytical methods, practical quantitation limits (PQLs), method detection limits (MDLs), and sensitivities for all water quality parameters.

Parameter	Analytical Method	Reporting Unit	Maximum PQL*	MDL	Sensitivity
Field Testing					
Flow	Calculated via USGS area-velocity method. Velocity measurements collected using Marsh-McBirney Flo-Mate Model 2000 Portable Flow Meter.	cfs	1	NA	0.1
pH	YSI 63 pH/EC Meter	pH units	0.1	2.0	0.1
Electrical Conductivity	YSI 63 pH/EC Meter	µS/cm	10	10	10
Dissolved Oxygen	YSI 550A Dissolved Oxygen Meter	mg O_2/L	0.1	0.1	0.01
Temperature	YSI 550A Dissolved Oxygen Meter	° Celsius	0.1	0.1	1
Turbidity	Orbeco-Helige Portable Turbidimeter Model 966	NTUs	1	1.0	0.5
Lab Measure					
E. coli	Quantitray Method**	MPN/100ml	2	1	1
Total Nitrogen	Yu, Z.S., R.R. Northrup, R.A. Dahlgren. 1994. Determination of Dissolved Organic Nitrogen using Persulfate Oxidation and Conductimetric Quantification of Nitrate-Nitrogen. Communications in Soil Science and Plant Analysis. 25:3161-3169. Total nitrogen (non-filtered sub sample) is determined as nitrate, using the Griess reagent method following persulfate oxidation.	mg/L	0.5	0.02	0.01
Total Phosphorous	SM 4500P-BE	mg/L	0.05	0.005	0.002
Ammonia	EPA 350.1	mg/L	0.1	0.01	0.005
Macroinvertebrate Community Composition	Collected in field using standard CDFG California Stream Bioassessment Protocol; laboratory analysis	NA	NA	NA	NA

***** The Quantitray method for *E.coli* analysis is referenced in: American Public Health Association, *Standard Methods for the Examination of Water and Wastewater.* Ed 20[th]. Washington DC, APHA, 1998, 9223B.

8. Special Training Needs/Certification

8.1 Specialized training or certifications.

Dr. Don Lancaster will be the primary person responsible for field measurements and collection of samples for laboratory analysis. Dr. Lancaster has over 30 years of experience conducting basic and applied research, including the past 10 years of working closely with Dr. Kenneth Tate, Rangeland Watershed Specialist at the University of California at Davis. Through this previous experience, Dr. Lancaster has been proficiently trained in the use of the various monitoring devices and sampling protocols that will be utilized in this project so that the data quality objectives listed above can be met. No other specialized training or certifications are required for this project. Further, Basic Laboratory, Inc. provides training to their staff as part of their Standard Operating Procedures (SOPs).

Although no specialized training is needed, Dr. Lancaster may be assisted throughout the project by Julie Laird, GLRCD project manager, or other UCCE-Modoc County Farm Advisor personnel in the collection of field data and laboratory samples. If this occurs, Dr. Lancaster will provide comprehensive on-site field training to each person assisting him with the collection of data and samples.

8.2 Training and certification documentation.

If GLRCD or other UCCE-Modoc County personnel assist Dr. Lancaster with the collection of field data and laboratory samples under this project, Dr. Lancaster (as the project's QA officer) will oversee their training. Dr. Lancaster will document on the field data sheet for the appropriate sampling event (i.e. the first sampling event the person is involved with) that he has provided adequate hands-on training in the field prior to the collection of any measurements or samples involving that person. Even if other people assist him in the data collection process, Dr. Lancaster will still be the primary person to collect measurements and readings, while the other person will primarily assist in the recording of the information. Dr. Lancaster will, however, note the date of the training, whether the training was an initial introduction or a refresher course for the person, and whether he felt the person satisfactorily completed the in-field training session. Documentation and storage of training records will be maintained with other project information at the UCCE-Modoc County Farm Advisor's Office, 202 West 4th Street, Alturas, CA, 96101.

Basic Laboratory, Inc. maintains records of their staff training. Those records can be obtained if needed from the laboratory's quality assurance officer.

8.3 Training personnel.

As noted above, Dr. Lancaster is the quality assurance officer for this project and will accordingly be responsible to oversee personnel training as well as to provide any necessary on-site field training if other GLRCD or UCCE-Modoc County personnel assist him with data and sample collection for this project. Dr. Lancaster has been fully trained in the measurement, sampling, and quality assurance protocols as described in this plan. Training sessions will be coordinated and lead by Dr. Lancaster on an as needed basis, depending on whether or not any GLRCD or UCCE-Modoc County personnel are helping him collect the data for this project. If additional personnel do end up assisting Dr. Lancaster, training for those employees will be mandatory. As mentioned above, Dr. Lancaster will still be the primary person to collect measurements and readings for this project, while the other person will primarily assist in the recording of the information. The training that is provided, however, will occur on-site in the field using a hands-on approach. Project staff will conduct multiple tests for all analyses and meet the data quality objectives described in Section 7 of this plan, if they will be the person to actually collect samples and measurements instead of only recording the information for Dr. Lancaster as he conducts the sampling events. If an employee does not meet the objectives of Section 7, Dr. Lancaster will re-train and re-test the employee. Additional training sessions will be scheduled by Dr. Lancaster for that employee until data quality objectives can be met. In the mean time, that employee will discontinue field sampling until training is completed and data quality objectives achieved. The quality assurance officer from Basic Laboratory, Inc. provides training to their personnel.

9. DOCUMENTS AND RECORDS

Documents and records that we expect to generate from this project include: QAPP, Monitoring and Reporting Program Plan (MRPP), Project Assessment and Evaluation Plan (PAEP), field data sheets, photographic documentation of each sampling site at each sampling event, instrument calibration records, a laboratory notebook (containing raw data received from the contract laboratory, duplicate results, etc), chain of custody forms, final data spreadsheets, and exceedance reports. In the case of detected exceedances, the GLRCD will adhere to the exceedance determination and reporting process described in the current MRPP and any future MRPP revisions. UCCE-Modoc County and the GLRCD will compile records for sample collection and field analysis. Basic Laboratory Inc. will generate records for sample receipt, storage, analysis, and reporting.

Further, throughout this project, Monthly Progress Reports will be submitted to the CVRWQCB that briefly describe the work performed, accomplishments, milestones achieved, monitoring results (if applicable), and any problems encountered. These reports are a specific requirement of the grant agreement and will not be required once the agreement is completed.

The Coalition will also submit an annual report to the CVRWQCB by 1 March, followed by quarterly data reports submitted by 1 June, 1 September, and 1 December each year. The data reports will include electronic data submittal in SWAMP comparable format as well as copies of all field, laboratory, and quality control reports as specified in the MRP Order. For the annual reports, the Coalition will include all elements described in the MRP Order, including electronic data submitted in SWAMP comparable format. In addition to the tabulated results of all analyses as submitted in the data reports, the annual report will include: a complete discussion of the monitoring results, updates on pesticide use or changes in agricultural practices, conclusions and recommendations that can be drawn from the current year's efforts, and any actions taken to address water quality exceedances. The Coalition will also include updates on outreach efforts to Basin growers as well as the progress made in the identification and implementation of management practices within the watershed. All information will be presented in a way that compliance with the Conditional Waiver is readily discernible.

Also, the Coalition will utilize field data and lab analysis results to determine if any water quality exceedances have occurred. If water quality objectives have been exceeded, we will submit an Exceedance Report to the CVRWQCB Coalition liaison via e-mail or fax that describes the exceedance, needed follow-up monitoring, and analysis or other actions the Coalition Group plans to take to address the exceedance. If more than one exceedance of any water quality standard occurs at the same site or within the area that the site represents within any three-year period (or if requested by the CVRWQCB Executive Officer), the Coalition will prepare a Management Plan to address the problem.

Lastly, Draft and Final Project Reports for the grant agreement will be submitted to the CVRWQCB summarizing the results and accomplishments throughout the project in order to satisfy the requirements of the grant agreement.

Hard copies of all documentation and records generated by this project will be stored at the UCCE-Modoc County Farm Advisor's Office, located at 202 West 4th Street, Alturas, CA, 96101. Laboratory records pertinent to this project will be maintained at the office of Basic Laboratory Inc. in Redding, CA. Copies of all records held by the laboratory will be provided to the UCCE-Modoc County Farm Advisor's Office and will be stored with the project files. Electronic copies of documentation and records, including data, will be stored on Dr. Don Lancaster's computer at the UCCE-Modoc County Farm Advisor's Office and on the GLRCD's laptop.

The project manager will be responsible for distributing MRPP, PAEP, and QAPP documents to project members and others as needed over the course of the project. The project manager will work with the QA officer to make certain that each person on the distribution list for this project receives the most current copy of the project's QAPP. Dr. Don Lancaster will be the primary person responsible for maintaining all sample collection, sample transport, chain of custody, and field analyses forms. Further, all documents and records will be made available for review by the CVRWQCB contract manager or other SWRCB/CVRWQCB representative upon request and in a reporting format appropriate to address the specific request. In general, data will be reported in tabular and graphical format to basin stakeholders along with accompanying interpretive text.

All records will be passed to CVRWQCB's contract manager Susan Fregien at project completion. Additionally, copies of the records will be maintained at the UCCE-Modoc County Farm Advisor's Office and at the contract laboratory for a minimum of five years after project completion. After five years, the copies of the records may be discarded, except for the project database that will continue to be maintained by the GLRCD on the district's computer (and backed up at the UCCE-Modoc County Farm Advisor's Office).

10. Sampling Process Design

The sample design and field data collection procedures are documented in detail in the project's Monitoring and Reporting Program Plan (MRPP). The relevant information from that MRPP regarding sampling process design has been included below. Further, an overall description of the Goose Lake Basin setting is provided in section 6 of this QAPP.

Sample Site Selection: Because of its ability to represent the geography, hydrology, and agricultural practices within the Goose Lake Coalition area, Lassen Creek will be the focal point of this monitoring effort. The Lassen Creek watershed is approximately 14 miles long, with the upper reaches falling within the boundary of the Modoc National Forest at elevations reaching nearly 7,500 feet. Moving down from the mountains, Lassen Creek stair steps its way to Goose Lake through a series of small mountain meadows and steep canyons. Stream flow in Lassen Creek is generated by snowmelt in the higher elevations of the watershed, with peak runoff occurring in the spring (April until mid-May). By the end of July, stream flow is significantly diminished and is primarily spring-fed other than occasional rainstorm events during this base flow period. Stream flow is diverted into open irrigation delivery ditches usually starting in April or May and ending in July or August, depending on the annual snowpack conditions and stream-flow levels.

Monitoring will occur at the Coalition's Lower Lassen Creek (LC 1) site. LC 1 is located below all irrigated agriculture activities in the Lassen Creek drainage. This monitoring design will allow us to characterize both the water quality and quantity below irrigated agriculture areas. The sample site will be identified by Global Positioning System (GPS) coordinates, as shown below in table 10.1. Sample frequency decisions were made to account for temporal variation in water quality during the summer irrigation season, as well as for changes between the summer irrigation season, spring runoff (snowmelt events), and storm events in the fall. The sampling process was also designed based on the requirements of the Conditional Waiver for Irrigated Lands.

The majority of the water quality constituents (pH, electrical conductivity, dissolved oxygen, water temperature, and turbidity) will be determined in the field during each sample collection event. The remainder of the constituents (*E. coli*, ammonia, Total N, Total P, and macroinvertebrate community composition) will be determined by analysis of grab samples collected and transported to Basic Laboratory in Redding, CA. Streamflow at the time of sample collection (instantaneous streamflow) will be determined via the USGS area-velocity method (width x depth x velocity).

As the project progresses, there may be a need to add or remove sampling sites and to adjust the timing of the sampling events depending on the results of sample analysis and at the direction of the CVRWQCB. If initial analysis reveals that water quality parameters are at levels that stress aquatic life or could potentially impair other identified beneficial uses, the Coalition will follow-up by first submitting the appropriate Exceedance Reports to the CVRWQCB. In order to help determine the persistency of the exceedance, additional monitoring events may be scheduled as soon as possible after the exceedance has been identified to determine if the water quality criteria continues to be exceeded. The Coalition, in consultation with the CVRWQCB, may also add additional monitoring sites above the irrigated land area in order to better evaluate the effects of agricultural discharge on stream conditions. If more than one exceedance of the same parameter occurs at one location within a three year period, the Coalition will work to develop a management plan to determine the source or cause of the exceedance (if not already known) as well as to specify management practices to correct the problem. The Coalition's monitoring plan will be updated with any changes to the monitoring locations and schedule as needed based on the types of exceedances detected.

Table 10.1 Sampling Location

Sample Site Designation	Sample Site Location	Purpose and other comments
Lassen Creek: Above Railroad Trestle	+ 41 53.494 N -120 21.562 W	Measure water quality and stream flow below irrigated agriculture for Lassen Creek subwatershed.

The following criteria were evaluated when choosing the sampling location for this project:

- Access to sample site is assured (points of public access and/or landowner agreement).
- Access to sample site is safe.
- Sample site allows for collection of a well mixed, representative sample of stream flow and water quality.
- Sample site is located below defined agriculture areas after irrigation return flows have entered the stream, and the stream is representative of the water quality conditions and agricultural management practices employed throughout the Goose Lake Basin.

Based on field conditions, the monitoring program may be modified by the project leadership during the sampling event to provide for field safety and make the collection accurate and thorough. The sample site is, however, accessible all year, except in the most extreme weather events. The landowner that controls access to the Lassen Creek sample site is a long time cooperator with the Goose Lake RCD and has ensured access to the site for this project. We do not anticipate the need to significantly adjust the sampling schedule (not including the possibility of having to end irrigation season sampling early due to the lack of water) or change sampling sites. If any such changes are necessary, however, they will be documented on the field data sheets and added to the project's MRPP as Appendices. We will also notify the CVRWQCB to ensure that the terms of the Irrigated Lands Program are still being satisfied.

Sampling Schedule: The irrigation season in the Goose Lake Basin usually begins in May and continues through August. In drought years, however, irrigation may begin in April and continue only until stream flows become too low for diversions to occur. Thus, sampling dates may have to be adjusted based on the conditions each year. Any changes will be included as updates to the monitoring plan.

The expected sampling schedule is listed above in Table 6.3. Monitoring will occur monthly during the irrigation season, with an additional event during the spring snowmelt season and another in the fall once irrigation has concluded and streamflows increase from summer base flow levels. The Coalition will make every attempt to conduct the fall sampling event after a rain event.

The duration, timing, and frequency of sample collection are further detailed in section 6 of this QAPP. Stream water samples will be collected during this project and analyzed for constituents as detailed in Table 7.2. The total number of samples collected will vary for the specific constituents based on the type of monitoring being conducted each year, as described in Section 6 of this document. All constituents and data collected in this project are considered critical for achieving the objectives of this project.

Previous monitoring efforts have revealed that there are some sources of natural variability that will need to be reconciled with project information as it is collected. Previous monitoring by both the CVRWQCB and UC Davis indicate that stream temperatures in Lassen Creek usually peak in July and August, with rapid reductions occurring during the first week of September. The study also showed that stream flow is highly correlated to water temperature, so that for every cubic foot per second (cfs) increase in stream flow, there tends to be an approximate 1.64ºF decrease in daily maximum stream temperature. Since stream flow varies significantly between years in the Goose Lake Basin based on each year's snow pack and weather conditions, this information will help us to interpret some of the monitoring results gathered through this project and will help us distinguish between natural background conditions and meaningful impacts that irrigated agriculture may be having on water quality. Possible sources of human bias and misrepresentation will be minimized by strictly adhering to the SOPs and approved methods outlined in this plan and its appendices.

11. Sampling Methods

Table 11.1 defines sample collection container type, minimum sample volume, preservation, and maximum holding time requirements per constituent. All sample collections will follow specific SOPs as described in the Quality Assurance Management Plan for the State of California's Surface Water Ambient Monitoring Program (SWAMP) and included in Appendix 2 of this QAPP. Particularly, "Section B2. Sampling Method Requirements" (http://www.swrcb.ca.gov/swamp/docs/qapp_sectionB2.pdf) and "Section B3. Sample Handling & Custody Requirements" (http://www.swrcb.ca.gov/swamp/docs/qapp_sectionB3.pdf) will be utilized to guide the sample collection process of this project. Acceptable samples will be those collected according to the specifications in these SOPs. Any deviations (and the reasons for them) will be documented in detail on the field data sheets and reported as appropriate with the data. Further, acceptable samples are those that are representative of the waterbody (i.e. not collected in a pool to the side of the creek, not directly beneath a discharge pipe, etc.) Samples also must be correctly labeled, preserved, transported, and documented with Chain-of-Custody forms to be acceptable. Further, all sample containers must be pre-cleaned and certified by the laboratory to be free of contamination according to the USEPA specification for the appropriate methods. Unacceptable samples will be those that do not meet any of the above listed criteria for acceptable samples. Dr. Don Lancaster will be responsible for knowing the procedures for proper sample collection as well as how to recognize and avoid potential sources of contamination. He will further ensure that anyone assisting him with sample collection understands these issues as well.

Dr. Lancaster, as the primary field data collector and project quality assurance officer, will be responsible for evaluating whether a sample has met the field conditions for sample acceptability, while Basic Laboratory will help the Coalition evaluate if proper sample preservation and transport has occurred. Dr. Lancaster and/or Basic Laboratory will report any problems that result in unacceptable samples to the CVRWQCB contract manager as well as to Julie Laird (project coordinator) and Herb Jasper (project director) to discuss how to resolve the problem. Dr. Lancaster will also consult with Dr. Ken Tate, Rangeland Watershed Specialist at UC Davis, who serves in an advisory role on this project. The group will together determine if follow-up action is appropriate. The project coordinator and project director will also work together to perform an annual review to ensure that field personnel are meeting the quality assurance criteria outlined in this plan. All problems and the corrective measures utilized will be thoroughly documented on field data sheets so that the resulting data can be interpreted correctly.

Stream water collection will be completed following the SWAMP SOP for "Field Collection of Water Samples" (http://www.swrcb.ca.gov/swamp/docs/primarystreamwatersampcollect_protocol.doc), and instantaneous streamflow, pH, electrical conductivity, dissolved oxygen, water temperature, and turbidity measurement will be completed following the SWAMP SOP for "Procedures for Conducting Routine Field Measurements in SWAMP" (http://www.swrcb.ca.gov/swamp/docs/appxe_fieldmeasureprocedures.doc) both of which are included in Appendix 2. For instantaneous streamflow measurements, the USGS method will be used for accurately determining flow during each specific monitoring event. If the USGS method cannot be used during a particular event (e.g. due to high flow conditions), flow measurements will be taken near the stream bank of the site or the float method will be used. The approximate location and number of streamflow measurements will be documented on the field data sheets. Any data files for flow data that have a high degree of uncertainty will be flagged.

Photographic documentation of the sampling site for each sampling event (as well as GPS coordinates to show the actual coordinates at the time of sampling) will be conducted by also following the SWAMP SOP for "Procedures for Conducting Routine Field Measurements in SWAMP", as referenced above. In accordance with the protocols outlined in that SOP, digital photos will be taken facing downstream, overlooking the sampling site, and facing upstream from the sampling site. Photos of both the right bank and left bank will be taken from the downstream-facing direction. Only one downstream photo will be taken, however, if both left and right banks fit into one frame. Any discrepancies from this convention will be documented. Photos will be recorded in the field data sheet. Further, any changes in monitoring locations during monitoring events will be photo-documented and also accompanied by GPS coordinates.

Further, in general, stream water samples will be collected via grab sampling from the edge of the bank or via wading. Samples will be collected from mid channel at mid depth. Water collection apparatus may include a stainless steel bucket for composite sampling. Sampling devices and sample bottles (that are not pre-sterilized and do not contain preservatives/fixing agents) will be rinsed three times with sample water prior to collecting each sample and may also be cleaned with Liquinox soap as needed prior to transport to the field in sealed containers. Sterile bottles and sample bottles that do contain preservatives/fixing agents will never be rinsed with sample water prior to collecting the sample. Further, we will never use a sample bottle containing preservatives/fixing agents for sampling. In such cases, we will use a sampling device to collect the sample prior to transferring the sample into the prepared bottle. All samples will be collected by submerging the bottle below the surface of the water, facing upstream. If the collector disturbs the sediment when wading, the collector will wait until the effect of disturbance is no longer present before taking the sample or will move upstream of the disturbance to obtain the sample. Water samples will be placed in an insulated container cooled by either wet ice or frozen ice packs and transported to Basic Laboratory for analysis, as described in further detail in section 12 of this QAPP.

Table 11.1 Sample collection, handling, and storage requirements.

Determination	Container	Typical Sample Volume	Preservation	Maximum Hold Time
E. coli	Factory-sealed, pre-sterilized disposable Whirl-pak® bags or 125 ml polyethylene or polypropylene container.	100 mL	Sodium thiosulfate is pre-added to containers by laboratory. 4 ^{o}C, dark	24 hours
Total Nitrogen	Polyethylene	300 mL	4 ^{o}C, dark	28 days
Ammonia	Polyethylene	500 mL	4 ^{o}C, dark	28 days
Total Phosphorus	Polyethylene	300 mL	4 ^{o}C, dark	28 days

All field sampling equipment will be cleaned according to the manufacturer's instructions. Because the Coalition has one primary monitoring site for this program, cross-contamination between sites from the sample equipment if not a major concern. However, to ensure the most accurate results, sampling equipment will be rinsed three times in the creek water before taking measurements or obtaining samples to eliminate any contamination that may have occurred during transport to the monitoring site.

Field samples will be disposed of in the field because no potentially harmful by-products will be created during the process of monitoring for instantaneous streamflow, pH, electrical conductivity, dissolved oxygen, temperature, and turbidity. Basic Laboratory, Inc. will follow their established quality assurance procedures for equipment cleaning maintenance and proper sample disposal. The Goose Lake RCD will pay the sample disposal fees charged by the laboratory.

12. SAMPLE HANDLING AND CUSTODY

(Sample preservation and storage procedures and requirements are detailed in Table 11.1.)

Immediately prior to collection, identification information for each sample will be recorded on the field data sheets. Samples will be labeled according to the following format: Site (#): + Date (MMDDYY) + Time (military, without colon). For example, a water sample collected at LC 1 on June 4, 2009 at 3:15 p.m. will be labeled LC1:0604091515. The field sampling staff will keep a field log for each sampling event that will include the sampling site, sampling location, sample matrix, sample type (i.e. normal field sample of quality control sample), sampling equipment, time of sample collection, sample identification numbers, the results of field measurements (instantaneous streamflow, pH, electrical conductivity, temperature, dissolved oxygen, and turbidity), the time measurements were made, descriptions of relevant water conditions and weather during sample collection, and any unusual occurrences during the sampling event (especially those that may affect sample quality).

Immediately following collection, all samples will be placed on ice. Upon completion of the sample collection, all samples for that collection event will be transported to the laboratory to be analyzed within the maximum hold time for each constituent. Dr. Don Lancaster, primary field sampling staff and project quality assurance officer, will be responsible for ensuring proper custody and documentation procedures. He will also be responsible for sample custody until samples are delivered to the laboratory, courier service, or shipping depot (as described below). Basic Laboratory, Inc. of Redding, California will perform *E. coli,* ammonia, Total N, and Total P analyses.

For samples to be analyzed by Basic Laboratory, Dr. Don Lancaster will either deliver them directly to the laboratory, to a courier service at a prearranged meeting point, or to a shipping depot to be mailed. In all scenarios, the samples will reach the laboratory in adequate time for analyses to begin before holding times are exceeded. A Chain of Custody (COC) document will be used to transfer the custody of the samples between field staff and laboratory staff. The COC form will identify the sample identification number (as described above), the date and time of collection, the name of the field sample collection staff, the date/time/location of the transfer, the name of the sample recipient, and the signatures of both the sampler and the sample recipient. The COC to be used for this project will follow the example given in the SWAMP Quality Assurance Management Plan, Appendix D, titled "Chain of Custody Blank Forms" found at http://www.swrcb.ca.gov/swamp/docs/appxd_coc_blankforms.xls. An example is also included near the end of Appendix 2 in this document. An example of Basic Laboratory's COC form can be found in Appendix G of their QAP (which is included with this plan as Attachment A). These forms will be utilized to follow the samples from the time they are collected until analytical results have been completed and submitted.

Once samples have been delivered to the laboratory following the procedures outlined in section 11 of this QAPP, the receiving laboratory will examine the samples for correct documentation, proper preservation, and holding times. The contract laboratory will follow the sample custody procedures maintained in their own QAPP. All samples that remain after analyses have been successfully completed will be disposed of properly, based on the procedures and requirements of the laboratory to ensure that all applicable regulations are followed during the disposal of samples and any related chemicals.

For any samples that are determined to not meet preservation and/or holding time requirements, Basic Laboratory will qualify the affected data (if possible) and will notify the sampling team and any other laboratory personnel so that corrective actions can be taken prior to the next sampling event. The laboratory and the project leadership team will also determine if any of the parameters must be re-sampled in order to obtain acceptable measurements.

13. ANALYTICAL METHODS AND FIELD MEASUREMENTS

Please see Table 7.2 for the list of analytical procedures, including field measurements that will be used for this project. Additional information on the analytical methods to be used is provided in Table 13.1 on the following page. The contract laboratory has Standard Operating Procedures (SOPs) for all analysis methods to be used (see Appendix 1). Basic Laboratory will provide results of all analyses to the Coalition within their standard turnaround time frame of two weeks.

The specific SOPs from Basic Laboratory that are included in Appendix 1 include:

- "Total Coliform and *E.coli* Detection and Enumeration by Quantitray (Document #MB-SOP-008)",
- "Ammonia as Nitrogen, Automated by EPA 350.1 (Document #GC-SOP-004)",
- "Total Phosphorus by SM 4500 P B/E (Document #GC-SOP-047)",
- "Total Dissolved Nitrogen (TDN) by Yu, Northrup, & Dahlgren 1994".

Within the above listed SOPs, the laboratory has identified the equipment and instrumentation needed for each analysis that they will perform. Please refer to these documents in Appendix 1 for equipment and instrumentation information. The methods utilized in this project are currently available to the public as standard methods and are referenced in scientific literature. These standard methods outline the reagents, standards, apparatus, instrumentation, and exact procedure for carrying out each analytical method. The laboratory conducts their daily work based on these documents.

Further, Basic Laboratory has established procedures for sample disposal. Please refer to the SOPs in Appendix 1 for this information. The laboratory includes specific disposal procedures where needed for particular tests but also describes their overall protocol for disposal in their laboratory Quality Assurance Plan (Attachment A). In that document, Basic Laboratory states that "all samples, digestates, leachates and extracts or other sample preparation products are disposed of in accordance with Federal and State laws and regulations. If the sample is part of litigation, disposal of the physical sample occurs only with the concurrence of the affected legal authority, sample data user, and/or submitter of the sample. Otherwise, all samples are disposed of 30 days after the final report is mailed to the client."

If any problems occur during laboratory analysis, the contract laboratory staff will contact the GLRCD. When an out of control situation occurs, analyses or work will be stopped until the problem has been identified and resolved. The laboratory will document the problem and its solutions and all analyses since the last control point must be repeated or discarded. The nature and disposition of the problem will be documented in the data report that is sent to the CVRWQCB. Further, the project manager will confer with the project director, QA officer and contract manager to communicate the problem and its solution. All problems and corrective measures will be documented in the laboratory notebooks. Additionally, specific corrective actions for each type of quality control are listed in Table 14.2.

For field measurements, the GLRCD will utilize an YSI 550A Dissolved Oxygen Instrument to measure both dissolved oxygen and water temperature, which the instrument is capable of providing simultaneously. To measure dissolved oxygen, the YSI 550A utilizes polarographic technology in the form of a membrane electrode as its principle of measurement. The sensor consists of a silver body as the anode and a circular gold cathode embedded in the end. In operation, this end of the sensor is filled with a solution of electrolyte containing a small amount of surfactant to improve wetting action. A thin semi-permeable membrane, stretched over the sensor, isolates the electrodes from the environment, while allowing gases to enter. When a polarizing voltage is applied to the sensor electrodes, oxygen that has passed through the membrane reacts at the cathode causing a current to flow. The membrane passes oxygen at a rate proportional to the pressure difference across it. Since oxygen is rapidly consumed at the cathode, it can be assumed that the oxygen pressure inside the membrane is zero. Hence, the force causing the oxygen to diffuse through the membrane is proportional to the partial pressure of oxygen outside the membrane. As the oxygen partial pressure varies, so does the oxygen diffusion through the membrane. This causes the probe current to change proportionally. The YSI 550A has a range of 0 to 50 mg/l and has a selectable resolution of 0.01 mg/l or 0.1 mg/l. For the range of 0 to 20 mg/L, the meter has an accuracy of ±0.3 mg/L or ±2% of the reading, whichever is greater. For the range of 20 to 50 mg/L, the YSI 550A has an accuracy of ±6% of the reading. For temperature, the instrument utilizes YSI Temperature Precision™ thermistors. The YSI 550A has a temperature range of -5 to 45ºC, a resolution of 0.1ºC, and an accuracy of ±0.3°C.

To measure streamflow velocity, the GLRCD will utilize a Marsh-McBirney Flo-Mate™ Model 2000 Portable Flowmeter, which provides stream velocity measurements from -0.5 to +19.99 feet per second. The instrument utilizes an electromagnetic sensor to measure the velocity in a conductive liquid such as water. The velocity is in one direction and displayed on a digital display as feet per second or meters per second. The Flo-Mate measures flow velocity using the Faraday law of electromagnetic induction. This law states that as a conductor moves through a magnetic field, a voltage is produced. The magnitude of this voltage is directly proportional to the velocity at which the conductor moves through the magnetic field. When the flow approaches the sensor from directly in front, then the direction of the flow, the magnetic field, and the sensed voltage are mutually perpendicular to each other. Hence, the voltage output will represent the velocity of flow at the electrodes. The Flo-Mate sensor is equipped with an electromagnetic coil that produces the magnetic field. A pair of carbon electrodes measure the voltage produced by the velocity of the conductor, which in this case is the flowing liquid. The measured voltage is processed by the electronics and output as a linear measurement of velocity. The Flo-Mate has a zero stability of ±0.05 ft/sec and an accuracy of ±2% of the reading + zero stability.

To measure turbidity, we will utilize an Orbeco-Hellige Portable Turbidimeter Model 966. The instrument is capable of measuring turbidity in three different ranges, including: low (0.00 to 19.99 NTU, with a resolution of 0.01 NTU), medium (00.0 to 199.9 NTU, with a resolution of 0.1 NTU), and high (000 to 999 NTU, with a resolution of 1 NTU). The Model 966 quickly and precisely measures the clarity or cloudiness of any type of fluid, with an accuracy of ± 3% of the reading for low and medium ranges. The instrument also has a repeatability of ±1%. A true nephelometer, the Model 966 tests at the officially mandated 90 degree angle between the photo-detector and the incident light beam (generated by infrared LED). Direct-reading displays give results in NTU's (Nephelometric Turbidity Units) over the full span of turbidity in all three ranges.

Lastly in order to measure both pH and electrical conductivity (EC), we will utilize an YSI Model 63 Handheld pH, Conductivity, Salinity and Temperature meter. It is a micro-processor based, digital meter with an attached pH, conductivity and temperature probe. The YSI Model 63 is autoranging, so that regardless of the conductivity or salinity of the solution (within the specifications of the instrument), the probe must simply be placed into the sample, and the instrument will automatically search for the appropriate range. For pH, the meter has a range of 0 to 14 pH units, a resolution of 0.01 units, and an accuracy of ± 0.1 pH unit within ±10°C of calibration temperature or ± 0.2 pH unit within ±20°C of calibration temperature. The Model 63 utilizes a pH sensor that is a combination electrode consisting of a proton selective glass reservoir filled with buffer at approximately pH 7 and an Ag/AgCl reference electrode which utilizes gelled electrolyte. A silver wire coated with AgCl is immersed in the buffer reservoir. Protons (H+ ions) on both sides of the glass (media and buffer reservoir) selectively interact with the glass, setting up a potential gradient across the glass membrane. Since the hydrogen ion concentration in the internal buffer solution is invariant, this potential difference, determined relative to the Ag/AgCl reference electrode, is proportional to the pH of the media. For conductivity, the Model 63 utilizes four different ranges (from 0 to 499.9 µS/cm, from 0 to 4999 µS/cm, from 0 to 49.99 mS/cm, and from 0 to 200.0 mS/cm). The resolution of the instrument corresponds to the four different conductivity ranges (0.1 µS/cm, 1.0 µS/cm, 0.01 mS/cm, and 0.1 mS/cm), and has an overall accuracy of ±0.5%FS. To measure EC, the YSI Model 63 has a conductivity cell that utilizes four pure nickel electrodes for the measurement of solution conductance. Two of the electrodes are current driven, and two are used to measure the voltage drop. The measured voltage drop is then converted into a conductance value in milli-Siemens (millimhos). The meter is also able to convert the conductance value to a specific conductance value in milliSiemens per cm (mS/cm) by multiplying the cell constant which has units of reciprocal cm (cm^{-1}). If the user selects "Conductivity" mode, the meter reports values of conductivity which are not compensated for temperature. If the user selects "Specific Conductance" mode, the Model 63 uses the temperature and raw conductivity values associated with each determination to generate a specific conductance value compensated to the temperature coefficient of 25°C. Though the YSI 550A will be the Coalition's primary means of measuring water temperature, the YSI Model 63 will be utilized as a back-up meter for temperature measurements. The Model 63 is capable of measuring temperatures from -5 to 75°C with a resolution of 0.1°C and an accuracy of ±0.1°C ±1LSD. For temperature measurements, the Model 63 utilizes a thermistor which changes predictably in resistance with temperature variation. The algorithm for conversion of resistance to temperature is built-in to the Model 63 software, and accurate temperature readings, in degrees Celsius, are provided automatically.

When physically deploying this equipment in the field to obtain measurements, the instruments are hand-held and placed in actively flowing water at mid-water depth (with the exception of the Portable Turbidimeter, where sample bottles are used to collect water to then pour into the vials that are read by the meter). The probes of the remainder of the instruments are connected to hand-held display units that show and record real-time measurements that will be copied onto field data sheets by the project's field staff. Equipment probes will be allowed a sufficient amount of time to stabilize before taking readings. For the YSI 550A instrument, the calibration/storage chamber will be maintained with 3-6 drops of clean water on the included sponge to ensure a 100% saturated air environment for the probe which is ideal for dissolved oxygen calibration. The YSI 550A's membranes will also be cleaned and replaced as per the manufacturer's recommendations in order to obtain accurate field data. For the Portable Turbidimeter, calibration will be validated using the supplied 40NTU USEPA approved styrene divinylbenzene copolymer standard. The glass vials for test samples will be maintained clean and lint free using distilled water and Kimwipes. For the YSI Model 63 meter, the short-term probe transport chamber will be maintained with 6-8 drops of tap water on the included sponge to create a humid environment for the pH sensor to prevent it from drying out during transport in the field (and storage up to one week). For long term probe storage, the pH sensor will be placed in the pH 4 buffer and KCl solution provided by the manufacturer, and then re-calibrated before subsequent field use. The Model 63's pH and conductivity sensors will be cleaned as per the manufacturer's recommendations and will be replaced if needed.

Please note the additional field sampling equipment information presented in Section 15 of the QAPP. For test and measurement failures, the Coalition will employ the corrective actions listed in Table 14.2. Further, the Coalition will utilize the troubleshooting guides for each instrument to resolve any minor errors that occur. If the Coalition cannot resolve any problems that arise, the equipment will be sent back to the manufacturer for repair.

Table 13.1 Additional analytical method information

Constituents, Parameters, and Tests	Matrix	Laboratory/ Organization	Laboratory Reporting Limit
Physical Parameters			
Flow	water	Field Measurement by GLRCD	N/A
pH	water	Field Measurement by GLRCD	N/A
Electrical Conductivity	water	Field Measurement by GLRCD	N/A
Dissolved Oxygen	water	Field Measurement by GLRCD	N/A
Temperature	water	Field Measurement by GLRCD	N/A
Turbidity	water	Field Measurement by GLRCD	N/A
Drinking Water			
E coli	water	Basic Laboratory Inc.	1 MPN/100ml
Nutrients			
Total Nitrogen	water	Basic Laboratory Inc.	0.02 mg/l
Ammonia	water (dissolved)	Basic Laboratory Inc.	0.05 mg/l
Total Phosphorous	water	Basic Laboratory Inc.	0.05 mg/l

14. QUALITY CONTROL

Quality control samples will be analyzed to ensure that valid data is collected. Depending on the particular water quality parameter (see Table 14.1 for the quality control measures to be used on each water quality parameter), quality control samples will consist of calibration check standards, field blanks, field duplicates, laboratory control spikes (LCS) and laboratory control spike duplicates (LCSD), matrix spikes (MS) and matrix spike duplicates (MSD), laboratory blanks, and laboratory duplicates (MS/MSD or LS/LSD pair may serve this function) (see Table 14.2 and the additional data acceptability criteria available in the SWAMP Quality Assurance Management Plan, Appendix C, titled "Data Acceptability Criteria, Target Reporting Limits, Sample Handling Requirements", located at http://www.waterboards.ca.gov/swamp/qamp.html#appendixc.) Additionally, other quality control exercises such as analysis of performance test standards will be conducted once a year to verify the proper working order of equipment and to determine whether the measurement quality objectives are being met. For all analyses, calibrations will be performed in accordance with SOPs and the equipment manufacturer's recommendations.

Standard procedures will be followed for the calculation of data quality indicators and applicable quality control statistics such as precision, accuracy, and identification of outliers (e.g. calculation of % difference between duplicate samples, calculation of the 95% confidence interval, % completeness of data generation, etc). Such calculations will be completed mostly in Microsoft Excel. Outliers will be identified by graphical analysis of the data in Excel.

Formulas that will be used for the calculation of data quality indicators and quality control statistics, as well as the objectives for these measurements are as follows:

- % Recovery (MS/MSD) = $[(V_{MS}-V_{Ambient}) / V_{Spike}] \times 100$
  - Where V_{MS} is the measured concentration of the spiked sample, $V_{Ambient}$ is the measured concentration of the original (unspiked) sample, and V_{Spike} is the concentration of spike added.
  - If the percent recovery for any analyte in the MS or MSD is less than the recommended warning limit, the chromatograms and raw data quantitation reports will be reviewed.

- Precision (RPD) of the MS/MSD pair = $[(V_{MS} - V_{MSD}) / \text{Mean}] \times 100\%$
  - Where RPD is the relative percent difference, V_{MS} is the measured concentration for the matrix spike, V_{MSD} is the measured concentration of the MSD, and Mean is the average of the two concentrations (of the MS and MSD).
  - The data quality objective for precision in MS/MSDs is 25% or less. If results do not meet this objective, the calculations and instruments will be checked, and the laboratory may be required to repeat the analysis to confirm the results. If the results repeatedly fail to meet the objectives indicating inconsistent homogeneity, unusually high concentrations of analytes, or poor laboratory precision, then the laboratory will halt the analysis of samples, identify the source of the imprecisions, and make corrections where needed before proceeding. If an explanation for a low or high percent recovery value is not discovered, the instrument response may be checked using a calibration standard, since low or high matrix spikes can be a result of matrix interferences. An explanation for low or high percent recovery values for MS/MSD results will be discussed in a cover letter accompanying the monitoring data reports to the CVRWQCB.

- % Recovery (LCS) = $(V_{LCS}/V_{Spike}) \times 100$
  - This is a measure of accuracy, where V_{LCS} is the measured concentration of the spike control sample, and V_{LCSD} is the concentration resulting from the spike amount added.
  - If the percent recovery for any analyte in the LCS, LCSD is outside the control limit, the chromatograms and raw data quantitation reports must be reviewed. Any corrective actions taken and resulting verification of acceptable instrument response must be included in the cover letter accompanying monitoring data reports to the CVRWQCB.

- Precision (RPD) of the LCS/LCSD pair = $[(V_{LCS} - V_{LCSD})/(\{V_{LCS} + V_{LCSD}\}/2)] \times 100\%$
  - Where RPD is the relative percent difference, V_{LCS} is the measured concentration of the spike control sample, and V_{LCSD} is the concentration resulting from the spike amount added.
  - The data quality objective for precision in LCS/LCSDs is also 25% or less. If results do not meet the objective, the same follow-up actions as described for MS/MSD precision will be followed, with an explanation included in the cover letter accompanying monitoring data reports to the CVRWQCB.

Please refer to Section 16 of this QAPP for the calibration and documentation procedures that the GLRCD will follow for field sampling equipment. Please refer to the laboratory SOPs in Appendix 1 for Basic Laboratory's procedures for managing the calibration of their laboratory equipment, including the frequency of calibration, how calibrations are to be performed and documented, and how deficiencies are to be resolved and documented. Additional information on these elements is also included in Attachment A--Basic Laboratory Inc. Quality Assurance Plan (QAP). This document has been included as an attachment instead of an appendix in an attempt to prevent this QAPP from becoming excessive in length.

Table 14.1 Quality control measures & instrument calibration/frequency requirements

Water Quality Parameter	Quality Control Measure	Instrument Calibration/Frequency
Instantaneous Streamflow	Maintenance & calibration practices of manufacturer.	SOPs and equipment manufacturer's recommendations.
pH	Replicate (3) measurements, check against second pH buffer, maintenance & calibration practices of manufacturer.	Calibration at start of sample run.*
Electrical Conductivity	Replicate (3) measurements, maintenance & calibration practices of manufacturer.	Calibration based on manufacturer's specifications. (System calibration for YSI 63 is rarely required because of factory

Water Quality Parameter	Quality Control Measure	Instrument Calibration/Frequency
		calibration for EC, but will check calibration at the beginning of each monitoring season.)
Dissolved Oxygen	Replicate (3) measurements, maintenance & calibration practices of manufacturer.	Calibration at start of sample run.*
Temperature	Replicate (3) measurements, maintenance & calibration practices of manufacturer.	Calibration against NIST certified thermometer at least twice per year. Will use correction factor table to correct for differences.
Turbidity	Replicate (3) measurements, maintenance & calibration practices of manufacturer.	Calibration check at start of sample run.* Calibration according to manufacturer's recommendations.
E. coli	Field and sterility checks (laboratory blanks) no detectable amounts or less than 1/5 of sample amounts for field blanks. All QA/QC procedures found in *Standard Methods* section 9020 and for selected analytical method. Accuracy at 1 per culture medium or reagent lot. Precision at 1 in 10 (10%) with at least one per batch.	Follow requirements of *Standard Methods* (18^{th}, 19^{th}, or 20^{th} editions) section 9020.
Nutrients	Laboratory and field blanks and duplicates, matrix spikes, method blanks, and laboratory control spikes. No detectable amount of substance in blanks. Accuracy, precision, recovery, and blanks at 1 in 20 (5%) with at least one in every batch. All QA/QC procedures of selected method.	External calibration with 3-5 standards covering range of sample concentrations. Calibration verification every 20 samples.

* Start of sample run is anytime on the same day as the sampling, prior to analysis of the first sample. We will consider recalibrating during the sample run if the instrument is turned off.

Table 14.2 Data acceptability criteria

QC Type	Definition	Frequency	Used to Evaluate	Limits	Corrective Action
Calibration Check (CC)	Standard solution with a known value or chemical concentration used to establish a correct instrument reading.	Every analytical batch per sampling event.	Accuracy Comparability	80-120%	Analysis cannot proceed unless the CC passes. Following successful instrument calibration, affected samples and associated quality control will be reanalyzed.
Field Blank (FB)	An aliquot of reagent water which is exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. The blank is used to provide information about contaminants introduced during sample collection, storage, and transport.	Every analytical batch per sampling event.	Accuracy	80-120%	If contamination of the field blanks and associated samples is known or suspected, the laboratory will qualify the affected data and will notify the sampling team so that the source of contamination can be identified and corrective measures taken prior to the next sampling event

QC Type	Definition	Frequency	Used to Evaluate	Limits	Corrective Action
Field Duplicate (FD) **(Co-located)**	An independent specimen collected from (as closely as possible) the same point in time and space as the primary specimen. This includes duplicate sample containers filled simultaneously and in close proximity to one another from the same medium, or duplicate containers filled in rapid succession from the same location or source.	Every analytical batch per sampling event.	Accuracy Precision Comparability	80-120%	For duplicates with a heterogeneous matrix and/or ambient levels below the reporting limit, failed results will be qualified. All failures will be communicated to the sampling team so that the source of error can be identified and corrective measures taken before the next sampling event.
Laboratory Control Spike & Laboratory Control Spike Duplicate (LCS/LCSD)	A specimen of known composition prepared using contaminant-free reagent water, or an inert solid, that is spiked with the analyte of interest at the midpoint of the calibration curve or at the level of concern; and then analyzed using the same preparation, reagents, and analytical methods employed for regular specimens.	Every analytical batch per sampling event.	Accuracy Comparability	80-120%	Perform instrument maintenance and prepare new standard solution if necessary. Affected samples and associated quality control will be reanalyzed if acceptance criteria are exceeded.
Matrix Spike & Matrix Spike Duplicate (MS/MSD)	A test specimen that is prepared by adding a known concentration of the target analyte(s) to a specified amount of a specific homogenized specimen and is then subjected to the entire analytical protocol.	Every analytical batch per sampling event.	Precision Accuracy Comparability	80-120%	For MS, results will be reviewed to evaluate matrix interference. If matrix interference is suspected, and reference material recoveries are acceptable, the MS result will be qualified. For MSD, appropriately spiked results will be compared to the MS and evaluated for matrix interference. If matrix interference is suspected and reference material recoveries are acceptable, the MSD result will be qualified.
Laboratory or Analytical Blank (LB or AB)	Clean water matrix, free of analyte. Analyzed in same manner as samples.	Every analytical batch per sampling event.	Accuracy	80-120%	If any analyte concentration in the blank is above the PQL, all samples associated with that method blank must be re-extracted and re-analyzed for that analyte. The exception is for common laboratory contaminants such as volatile solvents and phthalates, where all samples with an analyte concentration less than 10 times the method blank concentration and above the PQL must be re-digested and re-analyzed for that analyte. The sample concentration is not to be corrected for the blank value.
Laboratory Duplicates (LD)	Two or more representative portions taken from one homogenous sample by the laboratory analyst and analyzed in the same testing facility to evaluate the effects of laboratory conditions on analytical precision.	Every analytical batch per sampling event.	Accuracy Precision Comparability	80-120%	For duplicates with a heterogeneous matrix and/or ambient levels below the reporting limit, failed results will be qualified. Other failures will be reanalyzed as sample volume allows.

15. Instrument/Equipment Testing, Inspection, and Maintenance

A maintenance log will be kept for each instrument utilized in the project. The log will detail the dates of instrument and sampling gear inspection, calibration performance, battery replacement, and any noted problems. Crucial spare parts for the equipment will be maintained in the field kit. Any problems with the equipment will be corrected by the field data collector and other project staff as needed. If the problem cannot be corrected, the equipment item will be returned to the manufacturer for repair.

The project will utilize an YSI 550A meter to measure both dissolved oxygen and temperature. A Marsh-McBirney Flo-Mate Model 2000 Portable Flowmeter will be utilized to measure streamflow velocity. To measure turbidity, we will utilize an Orbeco-Hellige Portable Turbidimeter Model 966, and to measure pH and electrical conductivity, the project will use an YSI Model 63 Handheld pH, Conductivity, Salinity, and Temperature Meter. All of these instruments will be cleaned and maintained as per the manufacturers' instructions after each use. The YSI 550A meter membranes and solutions will be replaced according to manufacturer's specifications. Membranes will be checked for bubbles after replacement. Before each use, the YSI 550A meter will be checked to ensure that it is clean and in good working order. Routine maintenance of the flowmeter is limited to cleaning the sensor and changing the batteries. Oil and grease can cause noisy readings or conductivity lost errors of the flowmeter, in which cases the sensor will be cleaned with soap and water. If the problem still persists, the electrodes will be cleaned with very fine grit (600) sandpaper. For the turbidimeter, we will perform all maintenance as per the manufacturer's instructions, including replacing batteries and cleaning the sample vials with distilled water and Kimwipes. For the YSI Model 63, the meter will be checked to ensure that the sensors are clean and in working order. The pH sensor will be cleaned as per the manufacturer's instructions whenever deposits or contaminants appear on the glass of the sensor. In most cases, cleaning the sensor with tap water and a clean cloth or lens cleaning tissue will be adequate to remove all foreign material from the glass sensor. Maintaining a clean conductivity sensor for the YSI Model 63 meter will be key to producing accurate conductivity measurements. After each use, the conductivity cell will be rinsed with clean water. Routine cleaning will be conducted via the manufacturer's recommendations.

The field data collectors (primarily Dr. Don Lancaster, but may be assisted by GLRCD staff and/or other UCCE—Modoc County personnel) are responsible for calibrating, testing, inspecting, and maintaining all field equipment. The YSI meters will be calibrated before each use. Problems experienced in the field with the meters will be noted on the field data sheets and maintenance log and will be reported to project leadership and the contract manager and CVRWQCB QA officer as needed.

Basic Laboratory Inc. maintains their respective laboratory equipment in accordance with their own SOPs, which include those specified by the equipment manufacturers and those specified in the standard methods that they use for sample analysis. Please refer to these SOPs in Appendix 1 for information on testing criteria, availability and location of equipment spare parts, procedures for inspecting equipment before usage, identification of individuals responsible for testing, inspection and maintenance, and how deficiencies will be resolved and corrective actions documented. Additional information on these elements is also included in Attachment A--Basic Laboratory Inc. Quality Assurance Plan (QAP). This document has been included as an attachment instead of an appendix in an attempt to prevent this QAPP from becoming excessive in length.

16. Instrument/Equipment Calibration and Frequency

Please refer to table 14.1 that lists the instrument calibration protocols and frequency for each water quality parameter to be measured in this project. All equipment will be kept in proper working order. The YSI 550A meter, the Orbeco-Hellige Portable Turbidimeter Model 966, and the YSI Model 63 meter will be calibrated against standards and/or by the manufacturer's recommendations. The equipment will be inspected before each sampling event before leaving the office. The Flo-Mate Model 2000 flowmeter will be calibrated against a calibrated flume located on the UC Davis Campus once per year as arranged by Dr. Don Lancaster with on-campus research faculty. Basic Laboratory Inc. maintains their own calibration practices as part of their method SOPs (please see Appendix 1).

A calibration log will be maintained for all field sampling equipment. The log will be kept at the UCCE—Modoc County Farm Advisor's Office in order to ensure that it is safely maintained, and will only be taken to the field if the field staff identifies the need for re-calibration of the equipment in the field. During post-calibration checks, if it is determined that the acceptable amount of drift for an instrument has been exceeded, the data collected by that instrument during the particular sampling event will either not be submitted to the SWAMP program for inclusion in the database, or it will be appropriately flagged and tracked as deficient data. The field staff will resolve the problem with the instrument, either by conducting routine maintenance or by sending the instrument to the manufacturer for repair. The field staff will attempt to re-measure the affected field parameters as soon as possible after the deficiency was detected.

17. INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All solutions, equipment, and other supplies required for this project will be purchased new from reputable commercial sources and will be examined by project leadership upon receipt for any damage to the items. All solutions will be inspected by project staff to check for leaks or broken seals. All other sampling equipment will be inspected for broken or missing parts and will be tested to ensure proper operation. Field data collectors (primarily Dr. Don Lancaster) will be responsible for all field equipment (including solutions for the YSI 550A meter, the YSI 63 meter and the Orbeco-Helige Portable Turbidimeter Model 966) and for any laboratory supplies needed for field analyses.

Katie Hawley at Basic Laboratory is Goose Lake's contact with the contract laboratory and as such will oversee the individuals responsible for laboratory supplies, ensuring that the appropriate employees have critical supplies and consumables always readily available from approved sources. Katie Hawley will ensure for Goose Lake that the appropriate employees at the laboratory order supplies and consumables that meet established acceptance criteria and that proper procedures are followed for tracking, storing, and retrieving these materials. Specific information on how Basic Laboratory secures and approves critical laboratory supplies is included in the SOPs in Appendix 1. Additional information on these elements is also included in Attachment A--Basic Laboratory Inc. Quality Assurance Plan (QAP).

18. NON-DIRECT MEASUREMENTS (EXISTING DATA)

The only non-direct measurements that may be utilized in this project is the data from prior Goose Lake Basin water quality studies as described in Section II of the MRPP and provided as appendices to that document. This data will be utilized to help interpret the results of the current monitoring efforts. The existing data will also be useful in determining long term trends in the watershed as the GLRCD develops and evaluates Best Management Practices (BMPs) to mitigate the impacts of any water quality effects from irrigated agricultural discharge and identifies priority locations to implement such practices. The existing data will be reviewed as needed against the measurement quality objectives described in Section 7 of this QAPP. Only that data meeting all of the specified criteria will be utilized in this project.

Copies of these existing Goose Lake Basin water quality studies are currently kept on file at the UCCE-Modoc County Farm Advisor's Office in Alturas, California. Duplicates copies are also maintained by the project manager. Eventually, this data will be incorporated into an electronic database, as outlined in the Proposition 50 grant contract between the CVRWQCB and the GLRCD, which will summarize the available information regarding agricultural operations in the Basin. This database will also be maintained at the UCCE-Modoc County Farm Advisor's Office in Alturas, California, and a copy will be kept by the project manager on the GLRCD laptop computer.

19. DATA MANAGEMENT

Data management for this project will follow the strategy provided in the SWAMP Quality Assurance Management Plan, Section B10. Data Management (http://www.waterboards.ca.gov/swamp/docs/qapp_sectionB10.pdf) for data entry, data entry format, recordkeeping, tracking, and preparation for upload to the SWAMP IMS. This SOP is also included in Appendix 2 of this QAPP.

Field data sheets will be checked in the field by the field sample collectors. The project manager and QA officer will verify sample identification information and review the chain-of-custody forms. They will identify any results in which holding times have been exceeded, sample identification information is incorrect, samples were handled inappropriately, calibration information is missing or inadequate, or measurement quality objectives have not been met. This information will be brought to the attention of the project director and will be "flagged" upon entry into the project data spreadsheets. The contract manager may also be contacted as needed, and Dr. Ken Tate at UC Davis (who serves in an advisory capacity on this project) may also be asked to review questionable results. All field data sheets, laboratory analyses, and other documentation critical to the project will be stored securely as described in Section 9 of this QAPP. Please note that this project does not involve the collection of any continuous monitoring data (such as stream temperatures) so there are no such data files to maintain.

The project manager will oversee the entering of both field data and the results of laboratory analyses with the supervision of the project director and the project QA officer. Upon entering the data, the project manager will archive the field data sheets. Data will be entered into a Microsoft Excel spreadsheet that is compatible with SWAMP data reporting requirements. All electronic files will be stored on the GLRCD computer, and electronic copies will be sent to the UCCE—Modoc County Farm Advisor's office for storage on their computer system as well. Following the initial entry of data, the project manager will review the electronic data to ensure it presents the information from the original field data sheets/laboratory analyses accurately. Any data entry errors will be corrected. After performing these checks and ensuring that measurement quality objectives have been met, data analysis will be performed as needed to achieve the objectives of this project. The analysis will involve all members of the project leadership team. The computer equipment and software needed to manage the data for this project are either already available to the project team or will be purchased to satisfy the needs of this effort. Software utilized for data management will primarily included Microsoft Excel, though other programs such as Microsoft Access and S-Plus or other statistical software may also be used.

Monitoring results will be submitted to the CVRWQCB in Quarterly Monitoring Data Reports. Each year, the first report will cover from 1 January through 31 March and will be submitted by 1 June. The second report will cover 1 April through 30 June and will be submitted by 1 September. The third report will cover from 1 July through 30 September and will be submitted by 1 December. If no monitoring occurs during a given period, the associated quarterly data report will state that no monitoring occurred (as consistent with the Coalition's MRPP). The data reports will include electronic data submittal in SWAMP comparable format as well as copies of all field, laboratory, and quality control reports as specified in the MRP Order.

Further, as described in the MRP Order, the Coalition will submit an annual report by 1 March each year that covers all monitoring from the previous calendar year. The Coalition will include all elements described in the MRP Order, including electronic data submitted in SWAMP comparable format.

20. ASSESSMENTS & RESPONSE ACTIONS

The review of all field, contract laboratory analyses, and data management activities will be the responsibility of the project manager and the QA officer, working under the direction of the project director. The CVRWQCB QA officer may also be involved in any of these reviews as well. All three members of the project leadership team (the project director, project manager, and QA officer) have the authority to stop work if problems are found. They will also work together to suggest and implement any required corrective actions. All assessment information and corrective actions implemented by the project manager and QA officer will be reported to the project director electronically (via e-mail) or in hard copy (via mail). Depending on the results of the assessments and the efficacy of implemented corrective actions, in-person meetings or conference calls between the project manager, QA officer, and project director may also be warranted to discuss the details of these assessment activities. Training (as described in section 8 of this QAPP) will be used to correct any problems with data quality that can be attributed to project staff's implementation of SOPs, calibration and maintenance of equipment, etc. Retraining will be scheduled in these instances to ensure that measurement quality objectives will be met. For purposes of verification, any corrective actions identified by the project leadership team will be brought before Dr. Ken Tate, as part of his advisory role for the project, as well as the CVRWQCB contract manager. Implementation of these corrective actions will be recorded in the appropriate field and contract laboratory activity sheets and/or field staff training documentation. All field and contract laboratory activities, field data sheets, contract laboratory analyses, and maintenance logs will be available for review by CVRWQCB contract and quality assurance staff as requested.

Due to the relatively small size of the project staff that will conduct this monitoring program, the project director, project manager, and QA officer will remain in close contact on a regular basis to oversee and assess the progress of the program together. The leadership team will conduct reviews of field sampling procedures once during the irrigation season each year to determine if practices being used in the field correspond to the standards and protocol outlined in this QAPP.

21. REPORTS TO MANAGEMENT

The QA officer and project manager will collaborate to review the project's activities and assess whether this QAPP is being implemented as approved. The reviews will be conducted once per year, after sampling during the irrigation season has concluded. The results of the procedures conducted (as described in sections 14 through 17 of this QAPP) will be examined and compared to the data quality objectives (as listed in section 7 of this plan). The review will also include looking at the training records for the period under review. The QA officer and project manager, working with the project director, will identify any needed corrective actions if the review shows that the procedures being followed do not correspond to those specified in this QAPP or that the data quality objectives are not being met. Project staff may also consult with the CVRWQCB contract manager and/or QA officer to help resolve these issues. The QA officer and project manager will prepare a report summarizing the results of the review, including the need for any corrective actions identified and the steps taken to remedy the problem, to be submitted to the project director either electronically (via e-mail) or in hard copy (via mail or facsimile). An electronic copy of the QA status reports will also be submitted to Dr. Ken Tate for review. The reports will also be archived and stored as indicated in section 9 of this QAPP.

Further, throughout this project, Monthly Progress Reports will be submitted to the CVRWQCB that briefly describe the work performed, accomplishments, milestones achieved, monitoring results (if applicable), and any problems encountered. These

reports are a specific requirement of the grant agreement and will not be required once the agreement is completed. The Coalition will also submit an annual report to the CVRWQCB by 1 March, followed by quarterly data reports submitted by 1 June, 1 September, and 1 December each year. The data reports will include electronic data submittal in SWAMP comparable format as well as copies of all field, laboratory, and quality control reports as specified in the MRP Order. For the annual reports, the Coalition will include all elements described in the MRP Order, including electronic data submitted in SWAMP comparable format. In addition to the tabulated results of all analyses as submitted in the data reports, the annual report will include: a complete discussion of the monitoring results, updates on pesticide use or changes in agricultural practices, conclusions and recommendations that can be drawn from the current year's efforts, and any actions taken to address water quality exceedances.
Also, the Coalition will utilize field data and lab analysis results to determine if any water quality exceedances have occurred. If water quality objectives have been exceeded, we will submit an Exceedance Report to the CVRWQCB Coalition liaison via e-mail or fax that describes the exceedance, needed follow-up monitoring, and analysis or other actions the Coalition Group plans to take to address the exceedance. If more than one exceedance of any water quality standard occurs at the same site or within the area that the site represents within any three-year period (or if requested by the CVRWQCB Executive Officer), the Coalition will prepare a Management Plan to address the problem. Lastly, Draft and Final Project Reports for the grant agreement will be submitted to the CVRWQCB summarizing the results and accomplishments throughout the project in order to satisfy the requirements of the grant agreement.

22. Data Review, Verification, and Validation Requirements

Data generated by project activities will be reviewed against the data quality objectives cited in section 7 and the quality assurance/quality control practices listed in sections 14, 15, 16, and 17 of this QAPP. Data review, validation, and verification for this project will follow the guidelines provided in the SWAMP Quality Assurance Management Plan, Section D1 titled "Data Review, Validation, and Verification" (www.waterboards.ca.gov/swamp/qapp_sectionD1/pdf).

The QA officer, project manager, and project director will review, validate, and verify the data to determine if the data quality objectives have been met and if the data is suitable to achieve those objectives after each sampling event. If data does not meet the project's specifications, the project leadership team will review the errors and determine if the problem is due to equipment failure, calibration or maintenance techniques, or sampling/laboratory techniques. The team will implement necessary corrective actions, such as those described in Table 14.2, which may include additional training, revision of techniques, or replacement of supplies and/or equipment. If the problem cannot be corrected by one of these actions, the team will review the data quality objectives to determine if they are feasible. If any specific objective is not achievable, the team will determine whether the specific objective can be relaxed while still meeting SWAMP standards. Any revisions to the quality objectives used in the project will be appended to this QAPP with the date of the revision and an explanation for the reason for the modification. The project director will have the final authority on the data to be accepted by the project.

When the appended QAPP is approved, the project leadership team will work together to ensure that all data meeting the new quality objectives are entered into the project database. Any limitations or uncertainty in the data will be reported to the data user in each Quarterly Monitoring Data Report, with questionable data will be "flagged" so that it is easily identifiable.

23. Verification and Validation Methods

Standard procedures and algorithms as outlined in the SWAMP Quality Assurance Management Plan, Section B10, "Data Management" (http://www.waterboards.ca.gov/swamp/docs/qapp_sectionB10.pdf) and Appendix J, "Interim SWAMP Information Management System Plan (http://www.waterboards.ca.gov/swamp/docs/appxj_coverpage.pdf) will be followed for data validation and verification. The data validation and verification SOPs, forms, spreadsheet files, and checklists available on this website will be utilized in this project.

All required calculations will be completed in Microsoft Excel or other software packages as needed. The project director will have final authority on data validation and verification for all aspects of the project (including chain of custody forms, field and laboratory data, equipment maintenance logs, etc.) The project director will work with the project manager and QA officer to report the results of the data validation and verification in the project's final report. Data that does not meet stated measurement quality objectives, and thus is not validated or verified, will be "flagged" in the data spreadsheet that will be available to data users. Any problems identified during data review, validation, and verification processes will be corrected immediately via appropriate means (such as staff training, equipment calibration, equipment repair or replacement, etc). The project director, project manager, and QA officer will work together to implement any corrective actions identified. The corrective action will further be noted in the appropriate documentation log book, and the success of the corrective action will be communicated among the project leadership team.

24. RECONCILIATION WITH USER REQUIREMENTS

Because this project will follow the data management scheme provided in the SWAMP Quality Assurance Management Plan, Section B10, Data Management (http://www.waterboards.ca.gov/swamp/docs/qapp_sectionB10.pdf), it is expected that the data generated by the project will enter the SWAMP database and will be available for all applications of that system, including water quality compliance evaluation, Total Maximum Daily Load (TMDL) development, etc. Primarily, however, the data will be collected to achieve the objectives of this project. Any limitations or uncertainty in the data will be reported to the data user and will be flagged in all spreadsheets submitted to the CVRWQCB as part of the project's Quarterly Monitoring Data Reports and Annual Reports.